35 U.S.C. §103 Rejections

As a preliminary matter, Applicants submit that all pending claims are patentable over the cited references because no combination of the references teaches or suggests a method or an apparatus for polishing a surface of a workpiece comprising low-k material. Furthermore, as discussed in more detail with respect to the various claim rejections, no combination of the cited references teaches or suggests any operating parameters or equipment portions for removing material from a workpiece comprising low-k material.

Claims 1-9, 26-29 and 32-33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over United States Patent No. 6,409,580 B1, issued to Lougher et al. on June 25, 2002 (hereinafter "Lougher et al."). Applicants traverse this rejection.

The Examiner states that it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the invention of Lougher et al. with various limitations of claims 1-9 because it has been held that where the general conditions of a claims are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. Applicants submit that this reasoning is not applicable to the present case. Lougher et al. generally discloses a method and apparatus for conditioning a polishing surface. Lougher et al. does not disclose any workpieces with low-k material and therefore does not disclose any particular apparatus or portions thereof for removing material from a workpiece comprising low-k material.

Lougher et al. does not render obvious claim 1 or any of claims 2-9 that depend therefrom because Lougher et al. does not teach or suggest "An apparatus for polishing a surface of a workpiece, the surface including a low dielectric constant material" or, as the Examiner acknowledges, "a platen configured to orbit about an axis at a speed up to about 2000 revolutions per minute." Accordingly, claim 1 and claims 2-9 that depend therefrom are not obvious in view of Lougher et al. and Applicants therefore request that the Examiner reconsider and withdraw this rejection.

Claims 2, 4-6 and 9 are additionally allowable over Lougher et al. Claim 2 is additionally allowable over Lougher et al. because Lougher et al. does not teach or suggest "platen is configured to orbit at about an axis at about 1000 orbits per minute." Claim 4 is additionally allowable over Lougher et al., because, as the Examiner acknowledges, Lougher et al. does not

teach or suggest "an orbital radius of about 0.25 to about 1 inch." Claims 5 and 6 are additionally allowable over Lougher et al. because, as the Examiner admits, Lougher et al. does not teach or suggest a "platen...configured to move the workpiece relative to the polishing surface at a speed of about 0.8 to about 3.2 meters per second" as set forth in claim 5 or "the carrier is configured to apply about 0.25 to about 2 pounds per square inch pressure to the workpiece in the direction of the polishing surface" as set forth in claim 6.

Claim 26 is not obvious in view of Lougher et al. because Lougher et al. does not teach or suggest "A method for removing material from a surface of a workpiece, including low-k material" or "providing a workpiece comprising low-k material" or "placing the workpiece comprising low-k material in contact with a polishing surface" or " orbiting the polishing surface at a speed about 500 to about orbits per minute." Furthermore, because Lougher et al. does not teach or suggest any means for removing material from a surface of a workpiece comprising low-k material, it would not be obvious for one skilled in the art to form the invention set forth in claim 26 and claims 27-29 that depend therefrom from the teachings of Lougher et al. Accordingly, Applicants request that the Examiner reconsider and withdraw the 35 U.S.C. §103(a) rejection to claims 26-29.

Claims 32 and 33 are similarly patentable over Lougher et al. because Lougher et al. does not teach or suggest "a workpiece carrier proximate the polishing surface, wherein the platen and the workpiece carrier are configured such that the surface of the workpiece comprising a low dielectric constant material and the platen move at a relative speed of about 0.8 to about 3.2 meters per second" as set forth in claim 32 or "A method for removing material from a surface of a workpiece, including low-k material" or "providing a workpiece comprising low-k material" or "placing the workpiece comprising low-k material in contact with a polishing surface" or "moving the polishing surface and the workpiece comprising low-k material relative to each other at a speed of about 0.8 to about 3.2 meters per second" as set forth in claim 33. Applicants therefore request that the Examiner withdraw this rejection to claims 32 and 33.

Claim 10 stands rejected under the 35 U.S.C. §103(a) as being unpatentable over Lougher et al. in view of United States Patent No. 6,241,593 B1, issued to Chen et al. June 5, 2001 (hereinafter "Chen et al."). Applicants traverse this rejection.

Chen et al. generally discloses a carrier head, including a bladder, for use with a rotary platen polishing apparatus. Nowhere does Chen et al. teach or suggest that the polishing head disclosed in Chen et al. could be used with a polishing apparatus including an orbiting polishing station or polishing a workpiece comprising low-k material. Thus, it would not be obvious to one skilled in the art to combine Lougher et al. with Chen et al. and even if the two references were combined, the combination of the references does not teach or suggest each and every element of claim 1, from which claim 10 depends. Specifically, no combination of the references teaches or suggests "An apparatus for polishing a surface of a workpiece, the surface including a low dielectric constant material" or "a platen configured to orbit about an axis at a speed up to about 2000 revolutions per minute." Accordingly, claim 10 is allowable over the cited references and Applicants respectfully request that the Examiner withdraw this rejection to claim 10.

Claims 11, 30, and 31 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lougher et al. in view of United States Patent No. 6,416,384 B1, issued to Kawamoto et al. July 9, 2002 (hereinafter "Kawamoto et al."). Applicants traverse this rejection.

Similar to Chen et al., Kawamoto et al. only discloses a polishing apparatus including a rotating polishing table. Nowhere does Kawamoto et al. teach or suggest an orbiting polishing apparatus or how one could combine the rotary platen teachings of Kawamoto et al. with the orbiting polishing apparatus of Lougher et al. to form the claimed invention. Furthermore, even if the two references were combined, the combination does not teach each and every element of the claimed invention. Specifically, the combination does not teach or suggest "An apparatus for polishing a surface of a workpiece, the surface including a low dielectric constant material" or "a platen configured to orbit about an axis at a speed up to about 2000 revolutions per minute" as set forth in claim 1, from which claim 11 depends or "A method for removing material from a surface of a workpiece, including low-k material" or "providing a workpiece comprising low-k material" or "placing the workpiece comprising low-k material in contact with a polishing surface" or "orbiting the polishing surface at a speed about 500 to about orbits per minute" as set forth in claim 26, from which claims 30 and 31 depend. Accordingly, Applicants request that the Examiner reconsider and withdraw this rejection to claims 11, 30, and 31.

Claims 12-17, 20 and 25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chen et al. in view of United States Patent No. 6,036,582, issued to Aizawa et al. on March 14, 2000 (hereinafter Aizawa et al.). Applicants traverse this rejection.

Aizawa et al. generally discloses a chemical mechanical polishing apparatus divided into a plurality of rooms cleaned to different degrees. Nowhere does either Aizawa et al. or Chen et al. teach or suggest any polishing apparatus or technique for removing material from a workpiece including low-k material as set forth in independent claims 12 and 25. Several of the limitations of these claims as well as the respective dependent claims are directed to apparatus or process techniques designed to remove particular material from a surface of a workpiece including low-k material. Because neither Aizawa et al. nor Chen et al. teach or disclose apparatus or method for removing material from a workpiece that includes low-k material, no combination of the references renders obvious any of Applicants' claims directed to removing material from a workpiece including low-k material. Furthermore, as the Examiner acknowledges, no combination of the references teaches or suggests a "platen configured to move relative to a workpiece surface at about 0.8 to about 3.2 meters per second and a workpiece carrier configured to apply about 0.25 to about 2 psi to a workpiece in the direction of the platen" as set forth in claim 25. Accordingly, Applicants request that the Examiner withdraw this rejection to claims 12-17, 20, and 25.

Claims 18, 19, 22, and 24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chen et al. in view of Aizawa et al. in further view of Lougher et al. Applicants traverse this rejection.

As previously noted, none of the cited references teach or suggest any method or apparatus to remove material from a surface of a workpiece comprising low-k material. Furthermore, no combination of these references teaches or suggests "A polishing system for removing material from a wafer surface, the wafer including low-k material" or "a plurality of polishing stations, wherein at least one of said plurality of polishing stations includes a platen configured to move at about 0.8 to about 3.2 meters per second relative to the wafer comprising low-k material" as set forth in claim 12, from which claims 18, 19, 22, and 24 depend. Accordingly, claims 18, 19, 22, and 24 are patentable over the cited references and Applicants therefore request that the Examiner withdraw this rejection to claims 18, 19, 22, and 24.

Finally, claims 21 and 23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chen et al. in view of Aizawa et al. in further view of Kawamoto et al. Applicants traverse this rejection. Claim 12 is not obvious in view of the cited references because no combination of these references teaches or suggests "A polishing system for removing material from a wafer surface, the wafer including low-k material" or "a plurality of polishing stations, wherein at least one of said plurality of polishing stations includes a platen configured to move at about 0.8 to about 3.2 meters per second relative to the wafer comprising low-k material." Accordingly, claims 21 and 23 that depend from claim 12 are not obvious in view of the cited references and Applicants therefore request that the Examiner reconsider and withdraw this rejection to claims 21 and 23.

Conclusion

In view of the foregoing remarks and amendments, Applicants believe that the pending claims are allowable over the cited art and Applicants therefore earnestly request allowance of all pending claims. Should the Examiner find that any of the pending claims are not allowable over the cited references, the undersigned strongly requests that the Examiner call to discuss the case.

Respectfully submitted,

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VERSION WITH MARKINGS SHOWING CHANGES MADE

1. An apparatus for polishing a surface of a workpiece, the surface including a low dielectric constant material, comprising:

a platen configured to orbit about an axis at a speed up to about 2000 revolutions per minute;

a polishing surface attached to the platen; and

a workpiece carrier proximate the polishing surface.

2. The apparatus of claim 1, wherein the platen is configured to [rotate] orbit at about 1000 orbits per minute.

4. The apparatus of claim 1, wherein the platen [rotates] orbits with an orbital radius of about 0.25 to about 1 inch.

12. A polishing system for removing material from a wafer surface, the wafer including low-k material, comprising:

a plurality of polishing stations, wherein at least one of said plurality of polishing stations includes a platen configured to move at about 0.8 to about 3.2 meters per second relative to the wafer [surface] comprising low-k material;

a clean system including at least one clean station; and

a load station.

25. A polishing system for removing conductive material deposited onto low-k material, comprising:

a load and unload station;

a plurality of polishing stations, wherein at least one polishing station includes a platen configured to move relative to a workpiece comprising low-k material [surface] at about 0.8 to about 3.2 meters per second and a workpiece carrier configured to apply about 0.25 to about 2 psi to a workpiece in the direction of the platen; and

a clean system proximate the plurality of polishing station.

26. A method for removing material from a surface of a workpiece, including low-k material, comprising the steps of:

providing a workpiece comprising low-k material;

placing the workpiece comprising low-k material in contact with a polishing surface; and

orbiting the polishing surface at a speed about 500 to about orbits per minute.

32. An apparatus for polishing a surface of a workpiece, the surface including a low dielectric constant material, comprising:

a platen configured to move about an axis;

a polishing surface attached to the platen; and

a workpiece carrier proximate the polishing surface, wherein the platen and the workpiece carrier are configured such that the surface of the workpiece comprising a low dielectric constant material and the platen move at a relative speed of about 0.8 to about 3.2 meters per second.

33. A method for removing material from a surface of a workpiece, including low-k material, comprising the steps of:

providing a workpiece comprising low-k material;

placing the workpiece comprising low-k material in contact with a polishing surface; and

moving the polishing surface and the workpiece comprising low-k material relative to each other at a speed of about 0.8 to about 3.2 meters per second.